POLICY RESEARCH WORKING PAPER 2366

Fiscal Constraints, Collection Costs, and Trade Policies

Keiko Kubota

Empirical evidence supports the hypothesis that when tariffs and export taxes are important sources of revenue for developing countries, and when those countries have narrow tax bases and high tax rates, trade liberalization will come about when the governments diversify their revenue sources through efficiency-enhancing, revenue-increasing tax reform.

The World Bank
Development Research Group
Trade
June 2000

POLICY RESEARCH WORKING PAPER 2366

Summary findings

That free trade allows economies in an ideal world to achieve the greatest possible welfare is one of the few undisputed propositions in economics. In reality, however, free trade is rare.

Kubota argues that many developing countries intervene in trade at least partly to raise revenues and that episodes of trade liberalization are often linked to tax reform.

She proposes a formal model to explain why developing countries rely disproportionately on tariffs for government revenues, when tax reforms are expected, and under what conditions trade liberalization will take place.

The model uses the simple concept of the fixed costs involved in tax collection. When fiscal needs are limited and the infrastructure to monitor, administer, and collect taxes is not well-developed, it is optimal for governments to rely on a handful of easy-to-collect taxes, which generally includes trade taxes.

When fiscal needs expand, the excess burden on the tax base grows rapidly, and tax reform becomes necessary. Tax reforms reduce reliance on the existing tax base, often allowing the statutory tax rate to be lowered. This is a form of trade liberalization when it involves the trade sector.

Kubota defines trade liberalization in a somewhat unconventional way: *only* reductions in the rates at which the trade sector is taxed are considered trade liberalization. Tariffication of quotas, normally considered a form of trade liberalization, is treated as tax reform (expanding the tax base).

Kubota tests this hypothesis empirically, first through three historic case studies (Bolivia, Jamaica, and Morocco) and then through systematic econometric analysis. She constructs a set of panel data for 38 developing countries for 1980-92, using the statutory tariff rates published by UNCTAD.

She uses empirical tests to isolate the cause of trade liberalization. The results support her hypothesis: tariff rates are positively related to fiscal shocks and negatively associated with episodes of tax reform.

This paper — a product of Trade, Development Research Group — is part of a larger effort in the group to investigate the role of trade taxes in government revenues in developing countries. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Lili Tabada, room MC3-333, telephone 202-473-6896, fax 202-522-1159, email address ltabada@worldbank.org. Policy Research Working Papers are also posted on the Web at www.worldbank.org/research/workingpapers. The author may be contacted at kkubota@worldbank.org. June 2000. (33 pages)

Fiscal constraints, collection costs, and trade policies

Keiko Kubota*
The World Bank

Abstract

That free trade allows an economy to achieve the highest possible welfare in an ideal world is one of the few undisputed propositions in the economics profession. Yet, in reality, there is virtually no country that practices free trade. There are roughly three types of (not mutually-exclusive) reasons that explain why trade barriers are so prevalent. First, there are theories that show restricting trade can be an optimal policy, such as the infant industry story, strategic trade policy, and endogenous growth considerations. Second, many have argued that interest group politics drive governments to intervene in trade. Third, there is a revenue-raising aspect to tariffs and export taxes.

Trade liberalization is expected to be observed on different occasions depending on which of these is the main reason for the impediments to exist. In the first case, the underlying fundamentals must change in order for the optimal policy to be no longer the best. When interest group politics drive governments to elect trade barriers, it is often suggested that they can only be removed in times of extraordinary economic distress: the atmosphere of crisis enables governments to package macroeconomic reforms, which are absolutely crucial for the return of stability, with trade reforms, which are viewed desirable but are incidental to the immediate crisis. If governments are intervening in trade primarily to collect revenues, then trade liberalization is expected to be linked to tax reforms.

This paper argues the revenue-raising reason is important, particularly for less developed countries. It proposes a formal model to explain why less developed countries rely disproportionately on tariffs for government revenues, when tax reforms should occur, and under what conditions trade liberalization

*Views expressed in this paper are entirely those of the author and should not be attributed in any manner to the World Bank or to its member governments. The author wishes to thank John McLaren, Shubham Chaudhuri, Ronald Findlay, Xavier Sala-i-Martin, Ann Harrison, Jose Antonio Gonzalez, and participants of the International-Development seminar and the Macro-International workshop at Columbia University for helpful comments.

will take place. It does so by using a simple concept of fixed costs involved in collecting taxes. When the fiscal needs are small and the infrastructure to monitor, administer, and collect taxes is not well-developed, it is optimal for governments to collect a handful of easy to collect taxes, which generally includes trade taxes. When the fiscal needs expand, the excess burden on the existing tax base grows rapidly until tax reforms become necessary. Such reforms reduce the reliance on the existing tax base, and often allows the statutory tax rate on the existing base to be lowered, and this is trade liberalization when it involves the trade sector. It is important to stress that the term trade liberalization is used in somewhat unconventional way in this paper: *only* reductions of the rates at which trade sector is taxed are called trade liberalization; tariffication of quota, which is normally considered a form of trade liberalization, is treated as tax reform (base expansion).

This hypothesis is tested empirically, first by three case studies on Morocco, Jamaica, and Bolivia and then by a systematic econometric analysis. A panel data set of 38 developing countries for years 1980-1992 is constructed from the statutory tariff rates published by UNCTAD. The empirical tests attempt to isolate the cause of trade liberalization, and the results are supportive of the hypothesis this paper proposes.

1 Introduction

That free trade allows an economy to achieve the highest possible welfare in an ideal world is one of the few undisputed propositions in the economics profession. Even in the second best world, tariffs and export taxes are bad policies because they distort production as well as consumption decisions. Yet, in reality, there is virtually no country that practises free trade. Several reasons have been suggested for the existence and persistence of trade restrictions. These reasons can be roughly divided into three groups. First, there are theories that show restricting trade can be an optimal policy. These include the optimal tariff argument, the infant industry story,[1] strategic trade policy, and endogenous growth considerations. By definition, trade liberalization is undesirable under these scenarios unless the underlying fundamentals change.[2] The second group belongs to the political economy literature which argues that governments are *driven* to intervene in trade in order to protect powerful interest groups (see, for example, Hillman 1989). The trade barriers in this category cause inefficient allocation of resources unlike those in the first group. Once in place, the inefficiencies are difficult or impossible to remove except, as the

[1] Krueger (1993) explains that the infant industry argument was one of the main pillars of the "import-substitution" strategy adopted by the governments of many newly independent countries in the 1950s and early 1960s. These governments perceived international exchange to be beneficial mainly to the industrialized countries, and sought to achieve development through protection of carefully selected domestic industries, encouraged by the apparent success of the Soviet Union.

[2] The fall of the import-substitution strategy from grace is generally understood to be caused by an ideological shift rather than changes in the underlying economic fundamentals.

conventional wisdom of the literature has it, in times of extraordinary economic distress. In discussing the Latin American experience in the 1980s, Rodrik (1996) suggests that it is plausible that the atmosphere of crisis "enabled reformist governments to package fiscal reforms, which were absolutely crucial for the return of price stability with trade and industrial policy reforms, which were viewed desirable in the longer run but were incidental to the immediate crisis." Tornell (1995) uses a game theoretic approach to analyze the Mexican case of trade liberalization and shows that the shifts in balance of power between interest groups during macroeconomic crises tend to allow the government to introduce efficiency-enhancing but politically costly reforms. It is true that the macroeconomic stabilization and trade reforms are often observed together but there is no inherent reason why this "bundling" should take place (as Rodrik points out). In fact, Yatawara (1998) finds empirical evidence that macroeconomic crises precipitate trade tightening and not liberalization.

Rather than pursuing the political economy angle, I hope to shed some useful light by looking at the trade liberalization episodes in the context of public finance. The third reason for governments to impose trade restrictions is simply to raise revenues. This aspect is well-known and is documented, for example, by Riezman and Slemrod (1987). Revenues from international trade taxes are typically not large for developed countries but they are substantial for developing economies (**table 1**). Even developed countries such as the United States depended on trade taxes before they developed sophisticated tax collecting systems as Baack and Ray (1983), among others, observe. More generally, governments with limited administrative capacity tend to collect revenues from sectors that are easy to tax. For example, Mtatifikolo (1990) makes the following observation about Tanzania between 1974-84: "Taxes which do not require the creation of costly and more elaborate collection mechanism, such as sales taxes and Pay As You Earn, have been intensively used, while those where the degree of evasion is high and costs associated with identifying and assessing payers are high, tax effort is seen to be minimal." Administering income taxes and value-added-taxes requires more advanced techniques than collecting import tariffs which can be accomplished by merely posting some personnel at major harbors..[3] This stylized fact seems not to have been discussed extensively in the literature although there are notable exceptions. Mourmouras (1991) shows that optimal tariffs and inflation taxes can be positive in a small open overlapping generations economy when the only other revenue raising tool for the government

[3]Nimeiri (1974) writes "[t]he case for indirect taxation, and especially that on foreign trade in the Sudan, rests primarily on administrative simplicity. Import duties are both easy and cheap to collect since the tax can usually be collected more effectively from importers at a few points of entry. Elaborate accounting is not necessary and evasion is rather difficult." However, collecting tariffs is by no means effortless or costless, particularly in landlocked countries. In Bolivia, for example, the National Chamber of Commerce believes smuggling was so pervasive that uncollected taxes cost the government nearly US$450 m in 1997. The IMF is reported to propose an investment of $10m-15m in overhauling the customs service and reducing tax evasion (Economist, April 11, 1998). In general, "developing countries have relied mainly on foreign trade taxes because they are easier to collect" (Tanzi 1981).

is a tax on bonds. Heady and Mitra (1987) argue that tariffs can improve welfare when there are distributional concerns and the government is not free to tax all goods at different rates. Anderson (1997) conducts a series of welfare analyses comparing the outcomes under various assumptions when trade protection is removed partially and other forms of distortionary taxation and the government spending adjust endogenously. Gardner and Kimbrough (1992) explain the evolution of the tax system in the United States using a three-period model with a different tax regime for each period with *exogenous* switching between the regimes. According to their model, tariffs are a part of the optimal tax policy in the first two periods in US history. Corruption and evasion also make tax collection difficult, and enforcement costs provide a rationale for using narrow-based taxes even when Ramsey taxation is an option, as McLaren (1998) shows.

Table 1. Tax revenue by type of tax and by country group (percent of total taxes)

per capita income (US$ 1981) Range	Income taxes	Domestic taxes on goods and services		Foreign trade		Tax revenue as a % of GDP
		General sales & VAT	Excises	Import duties	Export duties	
Low Income	28.9	17.0	13.2	25.9	3.0	14.9
Low middle income	24.1	21.3	13.4	15.5	0.2	19.9
High middle income	24.2	23.6	10.0	16.1	0.2	22.3
OECD	32.2	19.0	10.4	0.5	..	33.1
All countries	27.3	20.2	11.7	14.5	0.9	22.5

source: Government Finance Statistics 1997 (1995 for Low Income Countries)

This paper proposes an *endogenous* evolution of the tax regime as a way of explaining the link between trade liberalization and tax reforms. First, it shows why tariffs can be a part of the optimal tax policy for a government with a revenue requirement constraint and a limited administrative capacity. That is, as long as the revenue requirements are not so large, the government's best policy is to tax a few easy-to-tax sectors in the economy, which generally include trade. Second, the paper discusses when the government should diversify its revenue sources to include taxes that are more costly to collect. The expansion of the tax base is desirable when there is an increase in revenue requirements because tax rates can not be raised without limit and the efficiency cost is likely to be convex.[4] Then, the paper turns to the conditions under which "trade liberalization" (defined in this paper as a decrease

[4]Clarete and Whalley (1987) found that the costs of trade taxes rose much more rapidly than those of domestic taxes as the rates were increased (in the context of a CGE model for the Philippines).

in tariff rates) is expected when a "tax reform" (defined as an expansion of the tax base) is introduced as a response to a fiscal shock. The government decreases its dependency on the existing base when it diversifies its revenue sources. It can even lower the rates (which is "trade liberalization" when it involves the trade sector) if the amount of tax revenues to be raised through the pre-reform base have declined despite the overall increase in the revenue requirements. For example, Morocco managed to "increase tax revenues from 20.9% of GDP in 1987 to 26.4% in 1993 without increasing tax rates. Statutory rates for the most important taxes [were] actually reduced, in some cases dramatically. Base broadening, improved administration, and certain other discretionary measures [made] such tax rate reductions possible" (Sewell and Thirsk 1998). Indeed, one of the goals of tax reforms in many countries is to lower the existing rates to improve equity and to reduce incentive distortions while increasing revenues at the same time. The essence of the story this paper proposes is the following: trade taxes exist for collecting revenues, fiscal shocks prompt source-diversifying tax reforms (base broadening), and trade liberalization episodes (tariff rate reduction) occur in the context of the new and more efficient tax regimes.[5]

By claiming revenue collection as the main motive of trade restrictions, I omit quantitative barriers from my discussion. This is not because they are less important or interesting. There is a large literature on the political economy of quantitative restrictions.[6] For the government's choice between tariffs and quotas, Cassing and Hillman (1985) propose a model of a government with revenue needs that seeks to maximize political support. When the domestic market structure is non-competitive, the two instruments have different effects. In their model, the optimal instrument for a government can be tariffs, quotas, or both depending on the specifications. Political considerations obviously play a role in the making of trade policies. My hope is to compliment, not replace, the contribution of the political economy literature with my analysis.

The plan of the paper is as follows. Section 2 presents a simple model that describes the optimal choice of tax rates and base for a benign government with revenue requirements. In section 3, I discuss three country case studies to illustrate the model I propose. In section 4, some empirical evidence using cross-country time-series data for 38 developing countries is presented. Section 5 concludes.

2 The Model

2.1 The consumer

The model is adapted from Yitzhaki (1979). The consumer is a representative agent with a linearly homogeneous Cobb-Douglas utility function and exogenous

[5] Taxing more sectors is efficiency enhancing because it reduces the excess burden of taxation.

[6] See, for example, Choi (1996).

income Y. This is pre-tax gross income which can also be considered as the factor endowment. Following the optimal taxation literature, I assume producer prices to be fixed. There are $n+1$ goods in the economy[7], where:

goods 1 to n: consumed domestically (including one imported good)

good $n+1$: produced domestically and exported (not consumed at home).

The indirect utility of the consumer is represented by:

$$V^* = \max V(Y, q_1, q_2, ..., q_n) = \max AY \prod_{i=1}^{n} (q_i^{-\alpha_i}) \tag{1}$$

where

q_i is the consumer price of i, and $q_i = (1+t_i)p_i$,

p_i is the producer price of i,

t_i is the excise tax on i,

$\sum_{i=1}^{n} \alpha_i = 1$,

The demand curve for good i takes the form:

$$x_i = \alpha_i(\frac{Y}{q_i}) \tag{2}$$

2.2 The Producer

The producers of domestically consumed goods are perfectly competitive with constant marginal cost p_i (fixed). The exporter is owned by foreigners (foreign direct investment), and it has increasing marginal cost and faces a flat demand curve since the economy is assumed to be small. The export sector is not taxed but is required to have an export license that restricts the quantity. The government sets the export quantity so that foreign exchange earnings will equal the payment required for the imports. Any resulting pure profits accrue to foreigners and do not affect the domestic income. These rather ad hoc assumptions are not necessary but I make them in order to avoid cluttering the model. Endogenizing the export tax complicates the algebra without changing the substance of the results.

2.3 The Government

The government has an exogenous revenue requirement G which is spent on items that do not enter the utility function of the consumer directly, such as national defense. Although an exogenous revenue constraint is by no means realistic, it is just a way to avoid modeling the expenditure side of the government which is not the focus of this paper. There are always exogenous components to a government's

[7] Alternatively, $n+1$ goods can be thought of as categories of taxes, such as income tax, sales tax, excise tax, etc.

revenue requirements such as the foreign debt borrowed by the previous government, or spending that is authorized by another branch of the government.[8] The tools of collecting revenues are assumed to be limited to tariffs and excise taxes although levying these taxes from all sectors will amount to a general consumption tax which is also equivalent to a lump-sum tax in the context of this model. The main feature of the model is that the tax on good i is assumed to have a fixed collection cost C_i associated with it. This is an attempt to model the observation that some taxes are easier to collect than others. If there were no such costs then the best policy for the government is to collect Ramsey taxes from all goods in order to eliminate the excess burden of taxation (see Sandmo 1976). There are several reasons why some taxes are harder to collect than others. The first that comes to mind is the structure of the economy. For example, black and gray markets are obviously hard to tax. Transactions in food crop markets in rural area are almost impossible to monitor, and therefore difficult to tax. Another reason is political considerations. The otherwise ideal sector to tax may be off-limits to the tax agency if it is controlled by a politically powerful individual or group. The Russian "oligarchs" are a good example.[9] Finally, but not least important, is the lack of administrative capacity. This factor often proves to be the bottleneck for tax reforms as documented by Patel (1997) among others.

The goods are indexed in the ascending order of collection costs. For the goods that are consumed domestically, this is without any loss of generality. To simplify the analysis, I have ruled out export taxes as discussed in the previous section.[10] For all $i \in [1, n]$, let collection costs associated with i be less than the total consumer spending, $C_i < \alpha_i Y$. Any sector l for which $C_l \geq \alpha_l Y$ is a sector that is impossibly expensive to tax, and hence, not a part of potential base. The government chooses the tax rates t_i and the number of goods taxed (tax base) γ to maximize the utility of the consumer subject to the revenue constraint (Y is normalized to one so that

[8] *The Economist* reports that the real problem causing Brazil's fiscal crisis is the rigid structure of government spending mandated by the constitution. Brazil collects some 30% of GDP in taxes but only two-thirds (18.4% of GDP) accrues to the federal government. "And just four budget items make up 90% of this: constitutionally mandated transfers to other branches and tiers of the government; civil-service pay; pensions and other welfare spending; and interest payment on federal debt" (Economist, September 26, 1998).

[9] Former Deputy Prime Minister Boris Y. Nemtsov charged that the Russia's wealthiest tycoons, or "oligarchs," orchestrated the removal of Sergei V. Kiriyenko, former Prime Minister, because he had become increasingly aggressive in trying to extract tax payment from their business empires (Los Angeles Times, August 30, 1998).

[10] If I allow the export sector to be taxed, the export and import taxes must be chosen so that the trade is balanced. This will depend on the elasticities of domestic demand and supply as well as whether the export good has a market power in the world. The amount of revenues to be raised from the goods that are produced and consumed domestically will change depending on whether one or both of the trade sectors is (are) taxed. All these are pertinent considerations to governments in the real world but they do not add any insight to the simple story I tell.

C_i and G are fractions of the total income):

$$\max_{t_i,\gamma} V(t(\gamma;G)) = \max_{t_i,\gamma} A \prod_{i=1}^{\gamma} [p_i(1+t_i)]^{-\alpha_i} \prod_{j=\gamma+1}^{n} (p_j^{-\alpha_j}) \tag{3}$$

s.t.

$$\sum_{i=1}^{\gamma} t_i p_i x_i - \sum_{i=1}^{\gamma} C_i - G = 0 \tag{4}$$

where I have used the fact that maximizing with respect to q and t are equivalent since the producer price is fixed. t is expressed as a function of γ and G because once γ is chosen for a given G, t is determined automatically to clear the budget constraint. The budget is assumed to be always balanced. The upper bound of the exogenous G is:

$$G \leq Y - \sum_{i=1}^{n} C_i \tag{5}$$

In Yitzhaki (1979), the number of goods are assumed to be sufficiently large to allow for a continuous approximation. I keep the goods discrete in order to capture the notion that there are a finite number of taxable sectors in an economy. Goods in the economy are generally divided into finite categories for taxation purposes although the varieties of goods can be very many.

For any given γ and G, the optimal tax is $t_i = t$ for all $i \leq \gamma$. That is, all goods that *are* taxed are taxed at a uniform rate (see Sandmo 1976). This is because the goods that are included in the tax base are taxed according to the Ramsey Rule, and Cobb-Douglas utility function implies a uniform Ramsey tax.[11] I can choose the unit of goods so that $p_i = p$ for all i since the producer prices are fixed. I make a final simplifying assumption that $\alpha_i = \alpha = 1/n$ for all i. The formal problem for the government can be rewritten as:

$$\max_{t,\gamma} V = \max_{t,\gamma} Ap(1+t)^{-\alpha\gamma} \tag{6}$$

s.t.

$$\gamma\alpha\frac{t}{1+t} - \sum_{i=1}^{\gamma} C_i - G = 0 \tag{7}$$

where I have substituted the expression for the demand curve (2) in the budget constraint. Government's policy choice $\{t, \gamma\}$ is feasible when $t(\gamma; G) \geq 0$ exists for

[11] If the elasticity of demand differed across goods, the optimal tax rates will equate the proportional reductions in quantities demanded. If all goods are normal and the cross-price elasticities are only of secondary importance, then the average tax rate will move in the same direction as the uniform rate. The collection cost associated with the good (along with the demand elasticity) will affect whether it will be included in the tax base but not the rate at which it will be taxed.

a given G. For a fixed tax base γ, it is clearly the case that the tax rate t must increase with the revenue requirement G.

Proposition 1 *The tax base γ that maximizes V is nondecreasing in G.*

Proof: in appendix.

At the margin, the government equates the welfare cost of the excess burden with the administrative cost of taxing another sector. This result says that at a low level of G (relative to Y), the government will choose optimally to tax a few sectors beginning with the least expensive to tax. It will add more sectors to the tax base as G increases. It will never take sectors out of the tax base unless G decreases (which does not happen very often in the real world).

Proposition 2 *The optimal tax rate decreases when the tax base expands (in the neighborhoods of the threshold levels of $G = \widetilde{G}$ such that $V(t(\gamma; \widetilde{G})) = V(t(\gamma+1; \widetilde{G}))$) (as illustrated in* ***figure 1****).*

Proof: in appendix.

Proposition (2) suggests that when a fiscal shock forces the government to undertake tax reforms, one could expect the existing tax rates to be reduced as long as the increase in the revenue needs was not huge. A reduction of the tax rate on imports *is* trade liberalization as defined in this paper. The intuition is straightforward. When a tax reform broadens the base, the share of revenues raised by the existing base declines. The rates at which the existing base must be taxed will go down if the reduction of the fiscal burden per sector is absolute despite an overall increase in the revenue requirements. The relationship between the revenue requirement G and the optimal tax base γ and rate t is depicted in **figure 1**. A fiscal shock which increases G will force the government to increase the tax rate, expand the tax base, or both. The response of the government is summarized as follows:

1. increase the tax rate and keep the tax base intact if the shock is small enough to keep the revenue constraint under the threshold value.
2. expand the tax base and *lower* the rate if the fiscal burden per sector declines.
3. expand the tax base and *raise* the tax rate if the fiscal burden per sector increases.

2.4 Discussion

The model predicts that a government with relatively low revenue requirements will optimally choose a narrow tax base. In almost all countries, international trade is one of the least expensive sectors to tax and therefore is included in the existing tax base. When there is a fiscal shock that increases the government's revenue needs, a natural response might be to tinker with the rates of tariffs and other existing taxes. If, however, the shock is relatively large, or if the existing tax rates are at or close to the revenue maximizing point, then raising the tax rates will not increase the revenues sufficiently. It will be necessary to reform the tax system. If there is a significant base broadening, either by including new sectors or removing exemptions from the existing base, then chances are that existing tax rates can be reduced. If the base expansion is relatively minor or the shock was extremely big compared to the pre-shock revenue requirements, then the tax rates may be raised at the same time. Trade liberalization is observed in the second case and trade tightening is observed in the other two cases. Obviously, trade liberalization is not restricted to reducing the tariff rates. In many episodes, removing the quantity restrictions or tariffication of quotas are the important components (these will come under base expansion in this model as noted before). I do not claim that changes in revenue constraints are the sole reason for trade liberalization for all countries at all times. Rather, my hope is to propose an alternative explanation for the instances of trade liberalization for which existing theories cannot fully account.

In the next section, I discuss events in three countries to illustrate the point the model makes, as well as to motivate the cross-country analysis that follows. Each of these countries underwent a significant tax reform in the mid 80s. The pre-reform tax system was narrow-based, had high marginal rates, and relied heavily on international trade sector for revenues. When these countries experienced grave fiscal shocks in the middle of 1980s, they responded by base-expanding tax reforms. Trade liberalization *followed* the base-expansion, that is, when alternative sources of revenues were (forecasted to be) secured.

3 Case studies

3.1 Morocco

Since independence, the government of Morocco intervened heavily in international trade in order to protect the local industry and to collect tax revenues. A series of balance of payment crises caused the authorities to embark on structural adjustment measures that included trade reforms. Although trade liberalization (reduction of taxes on imports in this paper) efforts began in tandem with other reforms, it was not until the comprehensive tax reform delivered alternative revenue sources that they truly took hold.

Until the 1970s, Morocco maintained the tax system inherited from France when

it achieved independence in 1956. There were many trade barriers in place during this period as the government followed the "import-substitution strategy." It started to raise tax rates rapidly around 1970 in order to meet increasing revenue needs. Between 1970 and 1983, corporate income tax rates were raised from 43 to 56%, the average import duty nearly doubled from 15 to 28%, and the sales tax on goods rose from 15 to 19%. Over the same period, however, the tax base was narrowed unintentionally due to various investment incentives, exemptions, and evasion.

Tax structure in Morocco (selected) (percent of total tax revenue)

Tax	1972	1980	1986	1992
Taxes on income and profits	20.7	24.0	25.8	30.0
agriculture tax	1.6	0.3	0.0	..
wages and salaries	4.6	9.3	12.3	15.0
business profits tax	13.6	12.3	10.5	14.0
other	0.7	2.1	3.2	1.0
Taxes on domestic goods and services	38.2	29.3	28.2	34.0
sales tax	12.8	13.8	15.2	25.0
excise tax	22.2	13.1	11.1	..
business license tax	2.5	1.4	1.3	9.0
Tax on international trade	32.3	40.7	40.6	21.0
customs duties	13.2	8.9	9.9	..
special tax on imports	2.7	15.0	8.4	..
sales tax on imports	16.4	12.5	17.3	..
petroleum levy	n.a.	n.a.	n.a.	10.0
Central Government tax revenue (% of GDP)	15.9	22.1	18.8	26.3

.. negligible

source: Ministry of Finance data (reproduced from Sewell and Thirsk 1998)

In 1975, there was a sudden increase in the price of phosphate rock, a major export that accounted for approximately a third of export revenues. The export boom was short-lived and a fall in the phosphate price caused a sharp deterioration of the government's fiscal position. Expenditures expanded more rapidly than the windfall justified in the first place and did not stop growing when the boom ended. In 1978, a balance of payments crisis forced the authorities to seek the support of the International Monetary Fund (IMF). Despite the stabilization program, the foreign debt continued to grow until the adverse shocks to terms of trade caused a second crisis in 1983. By 1985 foreign debt service absorbed 70% of Morocco's foreign exchange earnings. The short-term coping strategy of the government was to cut back expenditures, raise rates on existing taxes, acquire more credit from the central bank, and accumulate arrears. However, the government saw the need to address the revenue side in the longer-run and asked the IMF for technical assistance in reforming the tax system. The primary goals of the comprehensive tax reform of 1986, as expressed in the 1984 Framework Law, were to broaden the tax base and

to lower the marginal tax rates. A new VAT, a new tax on personal income, and a petroleum levy were introduced, and tax exemptions were reduced. Although the tax reforms were not an overnight success, the government remained steadfast in its commitment. Tax revenues rose eventually from 18.8% of GDP in 1986 to 26.3% in 1992 while rates were reduced at the same time.

The authorities embarked on trade liberalization around the same time as tax reforms. In order to expand the tax base as well as to make the trade regime less distortionary, many quantitative restrictions on imports were removed or made less stringent. Rate reduction also began in 1984 when the special import tax was lowered from 15% to 10% and the maximum customs duty rate was reduced to 60%. Further rationalization of the tariff structure was scheduled, but when the fiscal performance of 1984 proved disappointing, it was delayed and its magnitude was curtailed. When the special import tax was cut to 5% in 1987, an equivalent across-the-board increase in customs duties was implemented. In 1988, the special import tax and the customs stamp duty were merged into what was called a fiscal import duty, set at a 12.5% rate (UNDP-World Bank 1999). As the benefits of the comprehensive tax reform began to show, the government proceeded to reduce tax rates on international trade. By 1992, tax revenues from imports[12] constituted only 21% of the total, compared to over 40% in 1980.

Morocco's experience illustrates that even when the government is committed to liberalizing trade "tax reform [has] to precede tariff reform as part of a rational sequence of policy reforms (Sewell and Thirsk 1998)."

3.2 Jamaica

The Jamaican government's response to acute fiscal difficulty in the early 1980s was to increase the rates of import duties and excise taxes. Although these emergency measures were successful in raising revenues, the government perceived that a comprehensive tax reform was necessary due to wide-spread feelings of unfairness among the citizens as well as the pressure applied by the country's creditors. Tax reforms started in 1986. As a part of the comprehensive reform, the emergency surcharge on imports was lifted gradually beginning in the second year of the reform.

Jamaica is a small Caribbean nation which had capita income of $950 in 1986 (1985 constant US dollars). The economy experienced a severe and protracted recession between 1974 and 1980 during which real GDP contracted over 18%. Even when the economy turned around in the 1980s, its recovery was slow and fragile. The government negotiated three separate loan arrangements with the IMF, the World Bank and the United States government between 1981-82 and as a result, much of its economic policies in the 80s were influenced by these creditors. The

[12]The table of selected tax structure in Morocco, which is reproduced here from Sewell and Thirsk (1998), lists sales tax on imports as a component of taxes on international trade. This is not a conventional classification. In the context of this model, however, it is appropriate to include all taxes levied from goods produced abroad as taxes on international trade.

IMF conditionality included reducing the budget deficit to the target level of 10% by the fiscal year 1983. The World Bank trade liberalization and deregulation (of the citrus, and sugar industries). The United States government did not attach explicit conditions to its loans but influenced the policies subtly by funding projects, including a comprehensive tax reform.

In the early 1980s, government revenue as a percentage of GDP was about 23% which was higher than those of most other comparable income countries (see table 1.1). Jamaica's reliance on import duties was relatively low due to its membership in the Caribbean Community (CARICOM), which required its members to apply the CARICOM Common External Tariff. The pre-reform tax system was characterized by a narrow base, extremely high rates, complexity, and both horizontal and vertical inequity. These shortcomings led the government to start a study of how to simplify the tax system without reducing revenues. In 1983 while the study was underway, the fiscal stance of the government deteriorated sharply when the reveune from bauxite industry (the main foreign exchange earner) fell and the government's foreign exchange reserves were drained by soaring payments for its oil purchases and debt repayment. The government's immediate response was to increase the excise taxes on cigarettes and spirits in 1984, and to raise the import stamp duties dramatically in the following year: from 6 to 16 % on raw materials, from 10 to 30 % on capital goods, and from 10 to 40 % on consumer goods (Shoup 1991). These measures were successful in increasing revenues. In particular, revenues from import duties nearly tripled in one year. However, their distortionary effects were perceived to be considerable since the hike was dramatic and the rate structure was so complex as to make implementation rather arbitrary.

Tax reforms designed to address some of these problems started in 1986. The new tax system expanded the tax base, and the emergency surcharges on imports were removed gradually starting in 1987. The tax reform enabled the government to collect adequate revenues from an increased number of sources which in turn allowed it to "liberalize trade" (decrease tariff rates) in order to reduce the excess burden imposed on the economy.

3.3 Bolivia

Bolivia began to liberalize its trade regime in 1985. The reduction of tariff rates, which is what I define as trade liberalization in this paper, however, did not start until later in 1986. Bolivia's pre-reform tax system, like Morocco's and Jamaica's, had a narrow base and high rates, and raised two-thirds of the revenues from trade taxes. The country experienced a grave fiscal shock in the mid-80s, which prompted the government to undertake a comprehensive tax reform, and the resulting base-expansion allowed it to lower the tax rates (tariffs) on the trade sector.

In 1986, Bolivia was small, open, and one of the poorest countries in the Western Hemisphere with per capita income o f US$600 (1985 constant dollars). The country has had a volatile history caused by an intense political, ethnic and regional divi-

sion. This diversity is likely to have been responsible at least partially for Bolivia's fragmented and ineffective tax system prior to the reform.[13] The Bolivian economy has always been highly dependent on exporting natural resources such as silver, tin, and oil. Before the reform, two thirds of government revenues came from trade taxes (see table below), which was unusually high even for a developing country. The export duties come almost exclusively from the state enterprises, and are thus classified under direct taxes in the Bolivian tax code. In 1975, for example, two state-owned exporting companies Comibol (tin) and YPFB (petroleum) made up 44% of the central government revenue.

selected tax structure before and after the reform (%of revenue)

source of revenue	1975	1987	1989
direct taxes	52.3	55.8	61.5
domestic direct taxes (excluding exports)	18.1	10.4	11.6
enterprise tax (private companies)	6.9	n.a.	n.a.
personal income taxes	4.6	n.a.	n.a.
public enterprises (closely related to export taxes)	34.2	46.1	49.9
export taxes	(33.4)	(45.1)	(42.5)
indirect taxes	47.7	44.2	48.1
domestic indirect taxes (excluding imports)	18.1	26.7	33.2
excise taxes (alcohol and tobacco)	4.3	1.6	3.9
value added tax	3.2	13.5	23.4
import taxes	29.6	17.5	11.0

source: Thirsk (1998)

The rising revenues enjoyed by the government in the early 1970s due to high oil prices and increased oil production led the government to expand spending at least as rapidly. When the revenue growth tapered off in the second half of the decade, the government chose to finance the growing deficit with foreign loans, rather than to curtail expenditures. The global recession in the early 1980s caused a deterioration in terms of trade and a decline in export revenues, placing the Bolivian government in extreme fiscal difficulty.[14] The government resorted to seigniorage when foreign lending stopped and inflation spiraled out of control. Hyperinflation eroded the real value of tax revenues because of the government's inability to adjust the exchange rate to keep up with inflation, lags in the collection process, and also because taxes were specific rather than ad valorem.

[13] Cukierman et al. (1992) suggest a political model of tax reform where countries with a more unstable and polarized political system will have more inefficient tax structures.

[14] The collapse of the tin price, in particular, hurt the Bolivian government's revenues. Bolivia's fiscal shock took not the form of an exogenous increase in the revenue needs but an exogenous decrease in the tax receipts. However, the effects of the shock on the other sectors in the tax base was similar to an exogenous increase in the revenue needs since the "residual" revenue requirements (net of the tin sector) had indeed increased.

The new government of Paz Estessoro, elected in 1985, introduced a bold economic reform package called the New Economic Policy which included an extensive tax reform to be enacted in May 1986. The sweeping tax reforms were designed to increase revenues, improve efficiency of collection, and simplify the overall system. The old taxes that were plagued with ad hoc exemptions and loopholes were replaced by a set of new taxes that allowed few exceptions to the rules. A new Office of Tax Collections was established as an independent fiscal entity. A creative procedure to file tax returns was introduced to improve compliance. While the domestic component of the tax system was overhauled with an aim of increasing revenues, the international component was reformed to reduce distortions. The tariff rates were unified and reduced to 20% in August 1986, three months after the tax reforms went into effect.[15] A uniform tariff was aimed at removing the disparity of protection across sectors and at decreasing the scope for corruption at the border. The reduced rate was hoped to discourage smuggling. The government's dependency on import duties declined dramatically as the tariff rates were lowered.

3.4 Discussion

The experiences of Morocco, Jamaica and Bolivia illustrate the sequence of events that countries go through as the governments' revenue requirements expand. In all three cases, the prevailing tax systems had narrow bases. When there were increases in revenue needs, the governments responded first by raising the tax rates, even though they were generally aware of the efficiency costs of a tax system with a narrow base and high rates. Then fiscal shocks dealt final blows to the existing systems and the governments were forced to introduce tax reforms. Once the reforms took place, "trade liberalization " followed, sometimes immediately, sometimes with a lag. It is telling that trade reforms happened *after* the tax reforms in all three cases studied here. If the governments were "bundling," trade liberalization should precede other macroeconomic reforms since the government would have to take the indisputably desirable macroeconomic reforms hostage in order to introduce the "unpopular" trade liberalization. I *am* arguing, however, that both tax and trade reforms are components of one fiscal reform. They are generally not simultaneous in the real world with various frictions because alternative sources of revenues have to be secured before the government can weather the reduction in tariff revenues. These case studies provide motivation for the broader empirical work in the following section.

[15]Prior to August 1986, quantitative restrictions on trade were converted into tariffs. These are trade-liberalization in the normal usage of the term, but in the terminology of this paper, are an expansion of tax bases (*tax reform*).

4 Empirical Analysis

4.1 The Data

In this section, I take the first step in quantifying the relationship between fiscal shock induced tax reforms and trade liberalization. I use the statutory tariff rate data from *Directory of import regimes* (1994) published by UNCTAD. To my knowledge, nobody has used the time-series dimension of this panel data set before. Pritchett and Sethi (1994) find that statutory tariff rates do not always reflect actual rates, but as long as they move in the same direction this problem should not nullify my analyses. The tariff rates are sampled four times around 1982, 1985, 1988 and 1992 at the beginning of the fiscal year, which varies across countries (see appendix). This causes obvious timing problems which I address the best I can. The government revenue requirement variable and other control variables are taken from the Penn World Table, World Development Indicator (World Bank), the Government Finance Statistics (IMF), and the International Financial Statistics Yearbook (IMF). I do not have the data for the actual episodes of tax reforms and I attempt to proxy them by a combination of the existence of an IMF program, large increases in the share of general turnover taxes (or value added taxes) in governments' total tax revenues, and dramatic rises in the tax revenue to GDP ratio. The rationale for doing this are the following: an overhaul of the tax system tends to be a condition for IMF loans; a typical tax reform often involves a movement away from excise and international trade taxes to generalized indirect taxes; one of the goals for the tax reform is usually to increase the tax revenue.[16] The particular set of criteria and cutoff levels I used for the reported results are the following:

ReformDummy = 1 if
IMF program existed concurrently or in the previous year,
%change in revenue share of VAT to total taxes>.12,
or %change in tax revenues to GDP ratio>.06.

Seventy-five percent of the observations had a below 12% and 6% changes in the VAT share and the tax-to-GDP ratio respectively. These cutoff values (and to a lesser extent the criteria also) are inevitably arbitrary but the results are robust to minor alterations.[17] The reform dummy constructed using these criteria and cutoffs takes the value 1 about half the time, which may seem a little too frequent. However, considering that the data are for the crisis-plagued 1980s, this may in fact be an accurate representation. Other data sources are Datastream (LIBOR) and

[16] This was not the case for the 1986 tax reform in Jamaica, where one of the goals was revenue neutrality. I believe this is an exception rather than a rule.

[17] I used percentage point changes of the tax share variables, and concurrent as well as lagged existence of the IMF programs. I tried omitting one of the three criteria in turn to construct the dummy, which reduced the number of observations. I also altered the cutoff levels (the reported result used the 75 percentile as the cutoff). None of these changed the substance of the results.

the Barro-Lee data set (for education variables). Sources and definitions as well as the summary statistics of the variables are listed in the appendix. All variables except tariff rates are sampled annually. The exchange rate (level) is the calendar year average of the market rate (whenever available), and all other variables (except the tariff rates) are sampled at the end of the calendar year. The simple average of the mean tariff rates is only slightly higher for manufactured than primary goods although rates vary greatly across countries and items. The overall average of the tariff rate changes is negative, implying that the trend in the 1980s to early 1990s was trade liberalization. The countries sampled had IMF programs about a fifth of the time.

According to the model, a rise in tariff rates leads to an increase in revenues. In the real world, the relationship between the two is not so straightforward since there are many things other than tariffs and export taxes that influence the trade tax revenues. For example, the price of copper can soar independently of the supply condition, allowing the government of copper-exporting economy to collect more export tax revenues even as it reduces the tax rate. In this case, the correlation of the rates and revenues is negative. One piece of evidence supporting the model's underlying assumption is that the IMF economists often advise the governments suffering from balance of payments crises to raise tariff and other tax rates.[18] Since they have first-hand experience in analyzing the economies they advise, it seems reasonable to trust their expertise. Both the IMF and the World Bank appear to believe that a small increase in the tariff rate will lead to more revenues, judged by their publications.[19] Taking this evidence, albeit anecdotal, to mean that governments do perceive raising tariff rates as a way to increase revenues, I move on to analyze the relationship between fiscal shocks, tax reforms and tariff rates.

4.2 Estimation Results

In order to make the estimation manageable, I make an assumption that there is only one "threshold level of revenue requirement ($\widetilde{G}$)" that forces governments to expand their tax bases when they cross it. This is not a bad approximation since only one threshold matters to each government at any given time. I run regressions on changes in variables making the levels mostly irrelevant. One potential problem is the slope coefficient "b," **(figure 2)** which measures the sensitivity of the tax rate(s) to changes in the revenue requirements (G). By pooling the data with varying levels

[18] "Under pressure to comply with conditions set by international lenders, Prime Minister Sergei Kiriyenko of Russia today ordered a 3 percent increase on all import duties to raise revenues... Raising import duties was one of the demands of the International Monetary Fund and other lenders in order to start delivering $17.1 billion in new loans to Russia (The New York Times, July 19, 1998)."

Similar episodes of the IMF explicitly or implicitly recommending the tariff rate increases include Argentina (1997), South Africa (1993), India (1990), and Chile (1983).

[19] See for example, World Development Report 1988, Trade liberalization in IMF-supported programs (1998), Sewell and Thirsk (1998) and Mitra (1992).

of G and tax bases, I am estimating the average slope and assuming implicitly that the slopes do not change very much. This is a limitation but it seems to be a reasonable one given that it is not possible to assign which one of the hypothetical curves each country is on at a given time. Under this assumption, all countries share the initial relationship between the tariff rate and the revenue requirement:

$$t_0 = a + bG_0 \tag{8}$$

When there is an increase in G, the government can respond by simply increasing the tariff rate and keeping the tax base or expand the base (reform) and move to a new relationship:

$$t_1 = \begin{cases} a + bG_1 & \text{if no reform} \\ a' + b'G_1 & \text{if reform} \end{cases} \tag{9}$$

The change in the tariff rate is given by the following expression:

$$\Delta t = t_1 - t_0 = b(G_1 - G_0) + \{(a' - a) + (b' - b)G_1\}(\text{if reform=1}) \tag{10}$$

Rewriting (10) in a form that can be estimated:

$$\Delta t = \beta_0 + \beta_1 \Delta G + \beta_2 \text{ReformDummy} + \beta_3 G \cdot \text{ReformDummy} \tag{11}$$

where ΔG is the change in revenue requirements (fiscal shock), G is the current government revenue requirement, and the ReformDummy indicates the episodes of tax reforms. β_1, β_2, and β_3 estimate "b," the sensitivity of the tax rates to changes in fiscal needs, "a'-a," the decrease in average fiscal burden due to the base expansion, and "b'-b," the change in the sensitivities of the tax rate when G increases, respectively. β_1 is expected to be positive: tariff rates increase with the revenue constraints in the absence of a tax reform. β_2 should be negative: tax reforms reduce tariff rates, everything else constant. In order to justify my assumption that the slope coefficient "b" does not change very much across different revenue requirement levels, β_3 should be roughly equal to zero.

If the macroeconomic "bundling" argument is true, the sign of β_1 will be negative for large shocks and zero otherwise. Only when there is a big shock, can the government sneak in a trade reform. If the immediate response to shocks is to always tighten the trade restriction as Yatawara (1998) suggests, β_1 will be positive and the coefficient on the reforms β_2 would not be significant.

tabulation of results suggested by various theories

theory	β_1	β_2	β_3
this paper	positive	negative	$\simeq 0$
"bundling" argument	negative (for big shocks)	negative	–
Yatawara (1998)	positive	$\simeq 0$	–

I report the results of the estimation using the variables defined as the following:

ΔG :	% change in [Foreign Debt/GNP]*[LIBOR] (all in nominal)
Reform Dummy:	as defined in section 4.1
G :	share of government expenditure in GDP

I employ a proxy for a fiscal shock for the change-in-requirement variable (ΔG) instead of the actual changes in the expenditure. I do so because the foreign debt repayment obligations seem to be the best approximation of the fiscal requirement in the real world of money-printing and arrears-accumulating governments. I use the share of government expenditures in GNP for the revenue requirement variable (G) because I believe they reflect the governments' constraint the best.[20]

I begin by running a simple OLS regression. All three right hand side variables are lagged because these variables are sampled at the end of the calendar year while the dependent variable (change in mean tariff rates) is sampled at the beginning of the fiscal year. Unfortunately, the samples are not always taken in the years immediately after the changes occurred. This is a limitation of the data set but hopefully not a fatal one. The results support the prediction of the model: the tariff rate increases when there is a fiscal shock (the coefficient on the shock variable is positive and significant), and the tariff rate decreases when there is an expansion of the tax base (the coefficient on the reform variable is negative and significant).

Dependent variable = %change in mean tariff rates

variables	OLS1	IV	OLS2	OLS3	OLS4
intercept	-0.016	-0.027	0.052	-0.015	0.049
	(0.41)	(-0.46)	(0.85)	(-0.35)	(0.82)
lag(shock)	0.435**	0.531*	0.551**	0.496**	0.579**
	(3.36)	(1.87)	(3.20)	(3.70)	(3.43)
lag(reform)	-0.271**	-0.538**	-0.244*	-0.223**	-0.193
	(-2.58)	(-2.03)	(-1.71)	(-2.11)	(-1.36)
lag(gov't exp*reform)	0.007	0.022	0.006	0.046	0.038
	(1.59)	(1.63)	(0.92)	(1.04)	(0.57)
lag(seigniorage)			-0.604*		-0.446
			(-1.97)		(-1.43)
Δ exchange rate				-0.047**	-0.039*
				(-2.47)	(-1.90)
No of observations	75	49	57	73	57
adjusted R^2	0.187		0.241	0.252	0.278
F-score	0.000	0.008	0.001	0.000	0.001

t-statistics in parentheses

[20] I have used foreign debt to GNP ratio multiplied by LIBOR, plain foreign debt to GNP ratio (without multiplying by LIBOR), and actual collection of tax revenues in its place, all with qualitatively similar results.

** significant at 5% level
* significant at 10% level

There is a potential endogeneity problem with the government expenditure variable. To the extent that the shock variable is an imperfect proxy for the exogenous revenue requirement changes the economies face, both the error term and the government expenditure variable will pick up the effects of the omitted true shock variable. If this problem is prominent, I expect to underestimate the coefficient on the shock variable. There is also a concern that the tax rates and the expenditures are jointly determined. The simultaneity should not influence the estimates of other coefficients as long as there is no collinearity problem among the independent variables. In order to check for the potential problem, I replace the government expenditure variable with instruments: per capita real GDP, percent of population with at least primary education, and aid to central government expenditure ratio (first stage results reported in the appendix). The result using the instrumental variable technique is not very different from that of the OLS estimation. The coefficients still have the expected signs and are significant although less strongly so. Durbin-Wu-Hausman tests indicate that using least squares will not result in serious bias. I conclude that potential problems are not severe and report the OLS results hereafter.

Next, I experiment with adding additional explanatory variables, seigniorage and change in exchange rates, to the equation in order to improve the fit of the model. Seigniorage is defined as the ratio of the change in reserve money to total revenue *à la* Cukierman et al (1992). According to them, the propensity to print money differs across types of governments. Governments that tend to resort to seigniorage may have different policies in adjusting tariffs when faced with fiscal shocks. Changes in exchange rate is another type of shock that is likely to influence tariff policy. It can alleviate any endogeneity problem as well as add further explanatory power to the model. Results including these variables are shown in columns three through five. The coefficients have the expected signs and are significant when only one of them is added to the equation. They also improve the fit of the model without changing the results qualitatively, except that the coefficient on the reform variable is not significant in the last regression. The results of the estimations seem to provide some support for the hypothesis I propose although they are far from conclusive.

5 Conclusion

Tariffs and export taxes are important sources of revenue for most developing countries. In this paper, I show why governments may choose a tax regime characterized by a narrow base and high rates. I also argue that trade liberalization should be observed after the governments diversify their revenue sources through efficiency-enhancing and revenue-increasing tax reforms. The reforms are prompted by rises in revenue requirements. There is some empirical evidence to support this hypothe-

sis: tariff rates are positively related to fiscal shocks and negatively associated with episodes of tax reforms.

An important extension of the model would be to analyze the optimal tax decisions in a dynamic context. In the paper, many variables including the collection costs and income are predetermined and remain constant. In reality, they change over time. For the model to be truly useful, it needs to be able to answer such questions as "should the government invest in the infrastructure to improve the administrative capacity of collecting taxes now in order to make the future tax base expansions less onerous or wait until the economy is a little richer?" Endogenizing the government revenue constraint and incorporating quantity barriers into the discussion would also be interesting tasks for future research.

6 Appendix

6.1 Proofs

Proposition 1: The tax base γ that maximizes V is nondecreasing in G.

Proof: I show for all G and feasible tax rates $t(\gamma;G)$ and $t(\gamma+1;G)$, (1) V is concave in G, (2) $\gamma=1$ maximizes V at $G\approx 0$, (3) $V(t(\gamma+1;\widetilde{G}))>0$ at $G=\widetilde{G}$ s.t. $V(t(\gamma;\widetilde{G}))=0$, and (4) $V(t(\gamma;G))$ and $V(t(\gamma+1;G))$ cross only once.

(1) V is concave in G (in the range $t(\gamma;G)>0$ exists):

$$\frac{\partial V}{\partial G}=Ap(\gamma\alpha)^{-\alpha\gamma}(\alpha\gamma)(\gamma\alpha-\sum_{i=1}^{\gamma}C_i-G)^{\alpha\gamma-1}(-1)<0$$

$$\frac{\partial^2 V}{\partial G^2}=Ap(\gamma\alpha)^{-\alpha\gamma}(\alpha\gamma)(\alpha\gamma-1)(\gamma\alpha-\sum_{i=1}^{\gamma}C_i-G)^{\alpha\gamma-2}\leq 0$$

(2) As $G\to 0$,

$$\lim_{G\to 0} t(\gamma;G)=\frac{\sum_{i=1}^{\gamma}C_i}{\gamma\alpha-\sum_{i=1}^{\gamma}C_i}$$

and

$$\lim_{G\to 0} t(\gamma+1,G)=\frac{\sum_{i=1}^{\gamma+1}C_i}{(\gamma+1)\alpha-\sum_{i=1}^{\gamma+1}C_i}$$

The difference between the two tax rates is:

$$\lim_{G\to 0} t(\gamma;G)-\lim_{G\to 0} t(\gamma+1;G)=\frac{\alpha(\sum_{i=1}^{\gamma}C_i-\gamma C_{\gamma+1})}{(\gamma\alpha-\sum_{i=1}^{\gamma}C_i)[(\gamma+1)\alpha-\sum_{i=1}^{\gamma+1}C_i]}<0$$

because $C_\gamma<C_{\gamma+1}$ for all γ by construction. Therefore, as $G\to 0$,

$$t(1;G)<t(2;G)<...<t(n;G)$$

Since V is decreasing in t for a given γ, and decreasing in γ for a given t,

$$V(t(1;G))>V(t(2;G))>...>V(t(n;G))$$

at G arbitrarily close to 0.
(3) Rewrite the objective function (6) by substituting the expression for t:

$$V = Ap(\gamma\alpha)^{-\gamma\alpha}(\gamma\alpha - \sum_{i=1}^{\gamma} C_i - G)^{\gamma\alpha} \tag{12}$$

Let $\widetilde{G}$ be the level of G s.t.

$$V(t(\gamma;\widetilde{G})) = 0$$

$$\widetilde{G} = \gamma\alpha - \sum_{i=1}^{\gamma} C_i$$

At $G = \widetilde{G}$,

$$V(t(\gamma+1;\widetilde{G})) = Ap[(\gamma+1)\alpha]^{-(\gamma+1)\alpha}[(\gamma+1)\alpha - \sum_{i=1}^{\gamma+1} C_i - \widetilde{G}]^{(\gamma+1)\alpha}$$

$$= Ap[(\gamma+1)\alpha]^{-(\gamma+1)\alpha}(\alpha - C_{\gamma+1})^{(\gamma+1)\alpha} > 0$$

where I have used the assumption $\alpha > C_{\gamma+1}$.
(4) Let Δ be the log difference between $V(t(.,\gamma+1))$ and $V(t(.,\gamma))$:

$$\begin{aligned}\Delta &\equiv \ln[V(t(\gamma+1;G))] - \ln[V(t(\gamma;G))] \\ &= -(\gamma+1)\alpha\ln[(\gamma+1)\alpha] + (\gamma+1)\alpha\ln[(\gamma+1)\alpha - \sum_{i=1}^{\gamma+1} C_i - G] \\ &\quad +\gamma\alpha\ln(\gamma\alpha) - \gamma\alpha\ln(\gamma\alpha - \sum_{i=1}^{\gamma} C_i - G)\end{aligned} \tag{13}$$

Differentiating Δ with respect to G,

$$\frac{\partial\Delta}{\partial G} = \frac{-(\gamma+1)\alpha}{(\gamma+1)\alpha - \sum_{i=1}^{\gamma+1} C_i - G} - \frac{-\gamma\alpha}{\gamma\alpha - \sum_{i=1}^{\gamma} C_i - G} \tag{14}$$

Evaluating $\frac{\partial\Delta}{\partial G}$ at $G = 0$,

$$\frac{\partial\Delta}{\partial G}|_{G=0} = \frac{\alpha(\sum_{i=1}^{\gamma} C_i - \gamma C_{\gamma+1})}{[(\gamma+1)\alpha - \sum_{i=1}^{\gamma+1} C_i][\gamma\alpha - \sum_{i=1}^{\gamma} C_i]} < 0 \tag{15}$$

At G close to 0, Δ is negative (from part(2)) and decreasing. Let $\widehat{G}$ be the level of G s.t. $\frac{\partial\Delta}{\partial G} = 0$.

$$\widehat{G} = \gamma C_{\gamma+1} - \sum_{i=1}^{\gamma} C_i$$

For all $G > \widehat{G}$

$$\frac{\partial \Delta}{\partial G} = \frac{\alpha(\sum_{i=1}^{\gamma} C_i - \gamma C_{\gamma+1} + G)}{[(\gamma+1)\alpha - \sum_{i=1}^{\gamma+1} C_i - G][\gamma\alpha - \sum_{i=1}^{\gamma} C_i - G]} > 0$$

The intuition for the movement of Δ is the following. Two countervailing effects affect Δ as γ changes. First, the total fiscal burden $(G + \sum_{i=1}^{\gamma} C_i)$ is increasing in γ: Δ decreases with γ. The other is the excess burden of taxing only a subset of the economy, which is decreasing in γ: everything else equal, it is better to spread out the burden of taxation to as many sectors as possible. When G is very small, the first effect dominates. The marginal loss of welfare is higher for $V(t(\gamma+1;.))$ than for $V(t(\gamma;.))$ around $G = 0$ because more is taken out of the economy when an additional $(\gamma + 1th)$ sector is taxed. At $G = \widehat{G}$, the two effects exactly offset each other. The second effect (the reduction of excess burden) dominates for $G > \widehat{G}$. Therefore, $V(t(\gamma;.))$ and $V(t(\gamma+1;.))$ cross only once in the relevant range of G.

(1)$\sim$(4) prove that $V(t(\gamma;.))$ intersects $V(t(\gamma+1;.))$ from above, and does so only once in the relevant range of G. When G is close to 0, the smaller the γ, the higher the welfare. The difference in welfare (Δ) decreases initially $(V(t(\gamma;.))$ stays above $V(t(\gamma+1;.)))$ but starts to increase at $\widehat{G}$. Δ is increasing monotonically in G thereafter. Therefore the optimal tax base γ is nondecreasing in G, which was to be shown. ■

Proposition2: The optimal tax rate decreases when the tax base expands (around the neighborhoods of the threshold levels of $G = \widetilde{G}$ such that $V(t(\gamma;\widetilde{G})) = V(t(\gamma+1;\widetilde{G}))$).

Proof: $V(t(\gamma;\widetilde{G})) = V(t(\gamma+1;\widetilde{G}))$ implies

$$[\frac{1+t(\gamma;.)}{1+t(\gamma+1;.)}]^{\gamma} = 1 + t(\gamma+1;.)$$

Suppose $t(\gamma;\widetilde{G}) < t(\gamma+1;\widetilde{G})$. Then, the expression in the square bracket on the left hand side is less than 1. Since it is raised to the power of a positive integer, the entire left hand side is a number that is smaller than 1. On the other hand, the right side is larger than 1 by construction. This is a contradiction. Therefore, it must be the case that $t(\gamma;\widetilde{G}) > t(\gamma+1;\widetilde{G})$. ■

6.2 Definitions and sources of data

variable	source	definition
Δ mean tariff rate	UNCTAD (1994)	$\frac{statutory\ tariff\ rate_t - statutory\ tariff\ rate_{t-1}}{statutory\ tariff\ rate_{t-1}}$
shock	World Development Indicator (World Bank) Datastream	$\%\Delta\ \frac{Foreign\ Debt}{GNP} * LIBOR$ (all in nominal)
reform dummy	Government Fianance Statistics (various issues) Santaella (1996)	$\%\Delta$ in $\frac{tax\ revenue}{GDP}$ >cutoff $\%\Delta$ in $\frac{vat\ revenue}{total\ tax\ revenue}$ >cutoff if IMF program existed
Government expenditure	Penn World Table(5.4)	$\frac{government\ expenditure}{gdp}$
seigniorage	International Financial Statistics (various issues)	$\frac{reserve\ money_t - reserve\ money_{t-1}}{total\ revenue_t}$
Δ exchange rate	International Financial Statistics (various issues)	$\frac{exchange\ rate_t - exchange\ rate_{t-1}}{exchange\ rate_{t-1}}$
%population with primary education	Barro-Lee data set	
$\frac{\text{Aid}}{\text{Government Expenditure}}$	World Development Indicator (World Bank)	Aid (% of central government expenditures)

6.3 Summary Statistics

variable	N	Mean	Std.Dev	Minimum	Maximum
Mean Tariff Rates					
primary products	119	27.690	18.509	3.700	90.800
manufactured	119	31.759	21.524	6.900	114.300
all	119	30.632	21.304	6.000	102.200
Δ Mean Tariff Rates					
primary products	77	-0.112	0.278	-0.776	1.000
manufactured	77	-0.119	0.251	-0.742	0.522
all	77	-0.119	0.247	-0.749	0.441
shock	651	0.127	0.381	-0.542	3.949
IMF program	666	0.213	0.410	0	1
per capita real GDP	626	2297.49	1707.91	422	8257
gov't share in GDP	681	19.874	8.214	3.9	57.4
reform (dummy)	76	0.539	0.502	0	1
Seigniorage	498	0.159	0.270	-0.090	3.978
Δ exchange rate	612	0.823	6.376	-0.283	139.311
Δ Terms of Trade	468	0.040	0.230	-0.626	1.888
% population with primary education	594	52.392	25.325	5.540	97.91
% agriculture output in GDP	484	25.970	14.129	4.848	62.250
% aid in government expenditure	389	18.774	25.994	-0.252	180.246

6.4 Countries in regressions

country	actual observation year				fiscal year starts on
	1982	1985	1988	1992	
Algeria	.	85	89	92	January 1
Argentina	.	87	90	93	August 1
Bangladesh	83	86	88	93	July 1
Bolivia	.	86	.	.	January 1
Brazil	.	86	90	93	January 1
Burundi	80	86	88	.	January 1
Chile	.	87	88	92	January 1
Colombia	.	86	88	92	January 1
Cote d'Ivoire	80	87	.	.	January 1
Ecuador	.	86	89	93	January 1
Egypt	81	86	89		July 1
Ghana	82	87	.	.	January 1
Haiti	82	87	.	.	October1
India	81	87	90	92	April 1
Indonesia	80	87	90	92	April 1
Iran	80	87	.	.	March 21 or 22
Kenya	82	86	90	.	July 1
Korea	.	87	90	92	January 1
Madagascar	.	86	88	.	January 1
Malawi	.	85	88	.	April 1
Malaysia	81	87	88	92	January 1
Mexico	83	87	90	92	January 1
Morocco	82	87	.	93	January 1
Nepal	83	87	.	93	July 15
Nigeria	82	87	90	93	April 1
Pakistan	82	84	88	92	July 1
Paraguay	80	84	.	92	January 1
Sierra Leone	82	86	.	.	July 1
Sri Lanka	83	87	90	93	January 1
Sudan	80	86	.	.	July 1
Syria	82	85	.	.	January 1
Tanzania	82	86	88	.	July 1
Thailand	81	85	89	91	October 1
Tunisia	82	87	88	92	January 1
Turkey	.	87	88	93	January 1
Venezuela	.	87	89	92	January 1
Zaire	81	86	89	.	January 1
Zimbabwe	83	86	89	.	Jan 1 (~84), Jul 1

6.5 First stage regressions

variables	Dependant Variable	
	lag (reform*gov't exp)	lag (gov't exp)
intercept	7.236**	30.079**
	(2.86)	(10.81)
lag (shock)	1.649	2.451
	(0.30)	(0.26)
lag (reform)	18.851**	-0.629
	(10.88)	(-0.33)
per capita real GDP	-0.001*	-0.001*
	(-1.95)	(-1.66)
% population with primary education	-0.072**	-0.140**
	(-2.08)	(-3.64)
aid/government expenditure ratio	0.064	0.114**
	(1.52)	(2.46)
No. of observations	49	49
Adjusted R^2	0.76	0.55

t-statistics in parentheses
** significant at 5% level

References

[1] Abe, Kenzo. 1995. The target rates of tariff and tax reform. International Economic Review. Vol. 36, No. 4, pp. 875-885.

[2] Anderson, J. 1997. Trade reform with a government budget constraint. Boston College Mimeo.

[3] Baack, B.D. and E.J. Ray, 1983. The political economy of tariff policy: a case study of the United States. Explorations in Economic History. Vol. 20, No. 1, pp. 73-93.

[4] Barro, Robert and Jong-wha Lee. on-line data set.

[5] Bahl, Roy. 1998. The Jamaican tax reform: its design and performance. in Thirsk 1998a.

[6] Cassing, James and Arye Hillman. 1985. Political influence motives and the choice between tariffs and quotas. Journal of International Economics. Vol. 19, No. 3-4, pp. 279-290.

[7] Choi, Jay. 1996. A rationale for quota protection: a political economy approach. Eastern Economic Journal. Vol. 22, No. 4, pp. 421-424.

[8] Clarete, Ramon and John Whalley. 1987. Comparing the marginal welfare costs of commodity and trade taxes. Journal of Public Economics. Vol. 33, No. 3, pp.357-362.

[9] Cukierman, Alex, Sebastian Edwards and Guido Tabellini. 1992. Seigniorage and political instability. The American Economic Review. Vol. 82, No. 3, pp. 537-555.

[10] Currie, Janet and Ann Harrison. 1997. Sharing the costs: the impact of trade refrom on capital and labor in Morocco. Journal of Labour Economics. Vol. 15, no. 3.

[11] The Daily Telegraph. October 5, 1993.

[12] Diamond, P.A. and J. Mirrlees. 1971. Optimal taxation and public production: I – II. American Economic Review. Vol. 61, No. 1, pp. 8-27 and Vol 61, No.3, pp. 261-278.

[13] Dixit, A. 1985. Tax policy in open economies. in A. Auerbach and M. Feldstein, edd. *Handbook of public economics.* Amsterdam: Elsevier Science publishers B.V.

[14] Ebrill, Liam et al. 1999. Revenue implictions of trade liberalization. Occasional paper No. 180. Washington, DC: International Monetary Fund.

[15] The Economist. April 11, 1998.

[16] The Economist. September 26, 1998.

[17] Fernandez, Raquel and Dani Rodrik. 1991. Resistance to reform: status quo bias in the presence of individual-specific uncertainty. American Economic Review. Vol. 81, No. 5, pp. 1146-1155.

[18] Financial Times. December 28, 1990.

[19] Gardner, G. and K. Kimbrough. 1992. Tax regimes, tariff revenues, and government spending. Economica. Vol. 59, No. 233, pp. 75-92.

[20] Heady C. and P. Mitra. 1987. Distributional and revenue raising arguments for tariffs. Journal of Development Economics. Vol. 26, No. 1, pp. 77-101.

[21] Heston and Lawrence Summers. Penn World Table.

[22] Hillman, Arye. 1989. *The political economy of protection.* Chur: Harwood Academic Publishers GmbH.

[23] International Monetary Fund. various issues. Exchange arrangements and restrictions.

[24] _____. various issues. Government Finance Statistics.

[25] _____. various issues. International Financial Statistics.

[26] _____. 1998. Trade liberalization in IMF-supported programs. World Economic and Financial Surveys.

[27] Journal of Commerce. October 16, 1997.

[28] Krueger, Anne. 1993. *Political economy of policy reform in developing countries.* Cambridge, MA and London: The MIT press.

[29] Los Angeles Times. August 30, 1998.

[30] McLaren, John. 1998. Black markets and optimal evadable taxation. Economic Journal. Vol. 108, No. 448, pp. 665-679.

[31] Mitra, Pradeep. 1992. The coordinated reform of tariffs and indirect taxes. The world Bank Research Observer. Vol. 7, No. 2, pp. 195-218.

[32] Mourmouras, A. 1991. Infant governments and the fiscal role of tariffs, inflation, and reserve requirements. Journal of International Economics. Vol. 31, No. 3-4, pp. 271-290.

[33] Mtatifikolo, Fidelis. 1990. Tanzania's tax performance. Eastern Africa Economic Review. Vol. 6, No.1, pp. 55-67.

[34] The New York Times. July 19, 1998.

[35] _____. March 24, 1983.

[36] Nimeiri, Sayed. 1974. *Taxation and economic development. A case study of the Sudan.* Khartoum: Khartoum University Press.

[37] Patel, Chandra. 1997. *Fiscal reforms in the least developed countries.* Cheltenham: Edward Elgar Publishing Ltd.

[38] Pritchett, Lant and Geeta Sethi. 1994. Tariff rates, tariff revenue, and tariff reform: some new facts. The World Bank Economic Review. Vol. 8, No. 1, pp. 1-16.

[39] Riezman, R. and J. Slemrod. 1987. Tariffs and collection costs. Weltwirtschaftliches Archiv. Vol. 123, No. 3, pp. 545-549.

[40] Rodrik, Dani. 1996. Understanding economic policy reform. Journal of Economic Literature. Vol. 34, No. 1, pp. 9-41.

[41] Sandmo, Agnar. 1976. Optimal taxation: and introduction to the literature. Journal of Public Economics. Vol. 6, No. 1-2, pp. 37-54.

[42] Santaella, Julio. 1996. Stylized facts before IMF-supported macroeconomic adjustment. IMF staff papers. Vol. 43, No. 3, pp. 502-544.

[43] Sewell, David and Wayne Thirsk. 1998. "Tax reform in Morocco: gradually getting it right." in Thirsk 1998a.

[44] Stern, Nicholas. 1987. The theory of optimal commodity and income taxation: an introduction. in Newbery, D. and N. Stern. *The theory of taxation for developing countries.* Oxford: Oxford University Press.

[45] Tanzi, Vito. 1981. *Taxation in Sub-Saharn Africa.* Washington, DC: International Monetary Fund.

[46] Tanzi, Vito. 1987. in Newbery and Stern edd. *The theory of taxation for developing countries.* New York: Oxford University Press.

[47] Thirsk, Wayne. ed. 1998a. *Tax reform in developing countries.* Washington, DC: The World Bank.

[48] Thirsk, Wayne. 1998b. "Bolivia's tax reform" in Thirsk 1998a.

[49] Tornell, Aaron. 1995. Are economic crises necessary for trade liberalization and fiscal reform? The Mexican experience. in Dornbusch, Rudigar and Sebastian Edwards. edd. *Reform, recovery and growth.* Chicago: University of Chicago Press.

[50] United Nations Conference on Trade and Development. 1994. *Directory of import regimes.* Geneva: United Nations.

[51] United Nations Development Program and World Bank. 1990. Country Report 7. Morocco 2000: an open and competitive economy.

[52] World Bank. 1988. "Morocco: the impact of liberalization on trade and industrial adjustment." Report No. 6714-MOR. Washington, D.C.: World Bank.

[53] _____. current issue. World Development Indicator.

[54] _____. 1988. World Development Report. Washington, D.C.: Oxford University Press.

[55] Yatawara, Ravindra. 1998. Timing is everything: on the determinants of commercial policy switches. Columbia University dissertation.

[56] Yitzhaki, Shlomo. 1979. A note on optimal taxation and administrative costs. American Economic Review. Vol. 69, No. 3, pp. 475-480.

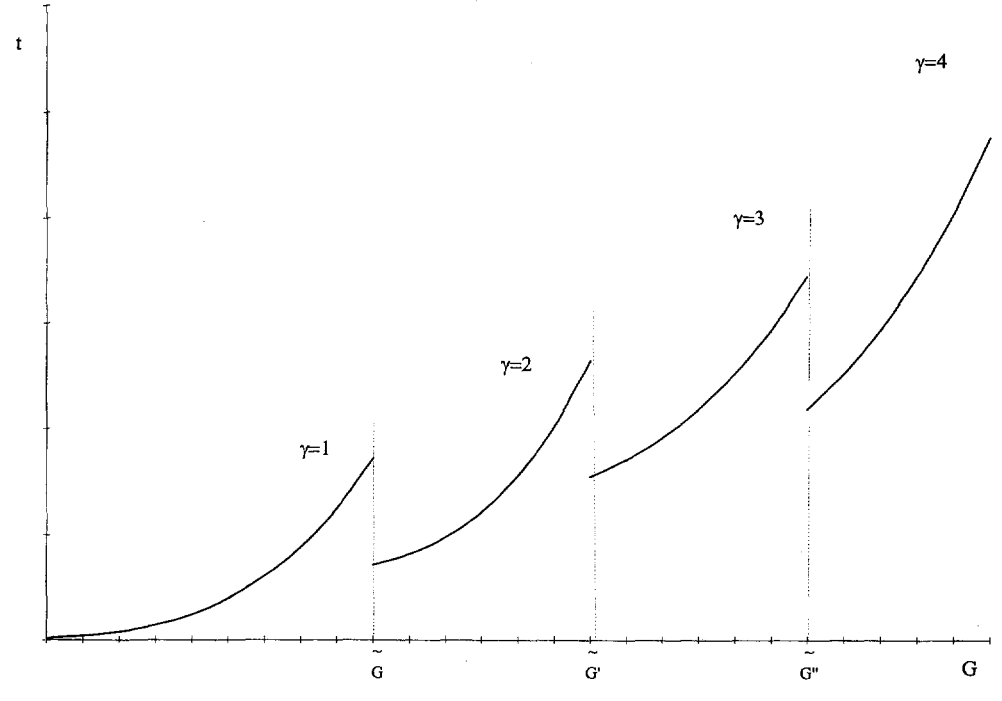

Figure 1: Optimal relationship of Revenue requirement (G), tariff rate (t), and tax base (gamma)

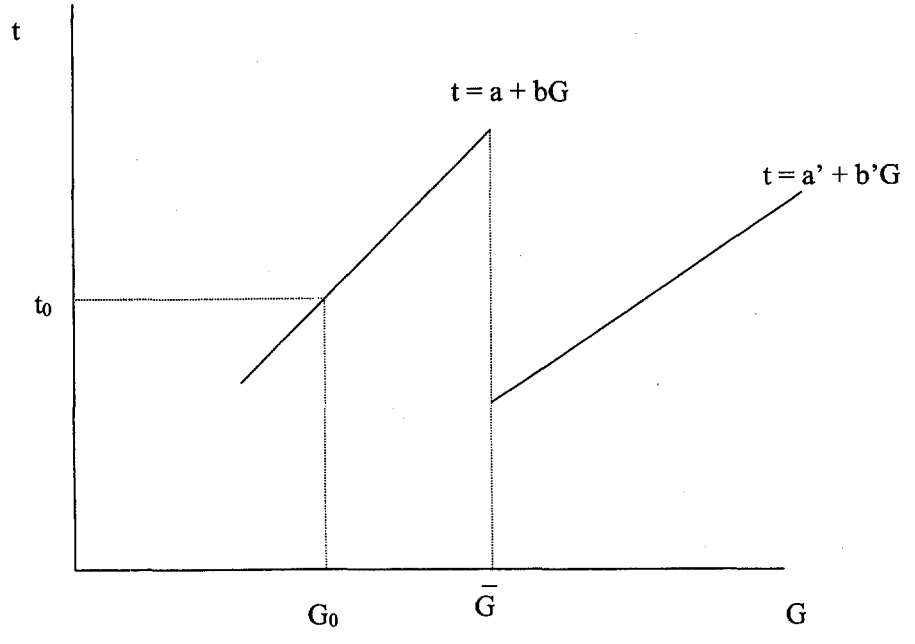

Figure 2: Log linearized relationship between Revenue requirement (G) and tax rate (t)

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2352	How Stronger Patent Protection in India Might Affect the Behavior of Transnational Pharmaceutical Industries	Carsten Fink	May 2000	L. Tabada 36896
WPS2353	The São Mateus-Jabaquara Trolleybusway Concession in Brazil	Jorge Rebelo Pedro Machado	May 2000	S. Van Veldhuizen 38722
WPS2354	When the Bureaucrats Move out of Business: A Cost-Benefit Assessment of Labor Retrenchment in China	Yi Chen Ishac Diwan	May 2000	M. Yafi 34649
WPS2355	Greed and Grievance in Civil War	Paul Collier Anke Hoeffler	May 2000	A. Kitson-Walters 33712
WPS2356	Bureaucratic Delegation and Political Institutions: When Are Independent Central Banks Irrelevant?	Philip Keefer David Stasavage	June 2000	P. Sintim-Aboagye 37644
WPS2357	Evaluating Carbon Offsets from Forestry and Energy Projects: How Do They Compare?	Kenneth M. Chomitz	June 2000	J. Ancrum 33512
WPS2358	Why Infrastructure Financing Facilities Often Fall Short of Their Objectives	Daniela Klingebiel Jeff Ruster	June 2000	M. Salehi 37157
WPS2359	Reducing Carbon Dioxide Emissions Through Joint Implementation of Projects	Will Martin	June 2000	L. Tabada 36896
WPS2360	Corruption and the Composition of Foreign Direct Investment: Firm-Level Evidence	Beata K. Smarzynska Shang-Jin Wei	June 2000	H. Sladovich 37698
WPS2361	The Welfare Effects of Private Sector Participation in Guinea's Urban Water Supply	George Clarke Claude Ménard Ana Maria Zuluaga	June 2000	H. Sladovich 37698
WPS2362	A Transitory Regime: Water Supply In Conakry, Guinea	Claude Ménard George Clarke	June 2000	H. Sladovich 37698
WPS2363	Would Collective Action Clauses Raise Borrowing Costs? An Update and Additional Results	Barry Eichengreen Ashoka Mody	June 2000	S. Kpundeh 39591
WPS2364	Perverse Effects of a Ratings-Related Capital Adequacy System	Patrick Honohan	June 2000	A. Yaptenco 38526

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2365	Leading Indicator Project: Lithuania	Stephen S. Everhart Robert Duval-Hernandez	June 2000	M. Geller 85155